

## WHAT IS CLAIMED IS:

- sub a, 7
- Rule 126
1. A protection switching arrangement for optical switching systems comprising:  
a plurality of optical switching matrices having multiple inputs and multiple  
5 outputs and being operable to optical channel signals from any one of a plurality of the  
inputs to any one of a plurality of the outputs;  
a plurality of wavelength division demultiplexers coupled at its outputs to the  
inputs of the plurality of optical switching matrices for dividing a composite optical  
signal into optical channel signals and providing each optical channel signal to a  
10 corresponding optical switching matrix;  
a spare wavelength division demultiplexers coupled at its outputs to the inputs of  
the plurality of optical switching matrices for dividing a composite optical signal into  
optical channel signals; and  
at least one optical protection switch having a plurality of inputs and a plurality  
15 of straight-through outputs and at least one protection output and coupled at each of its  
straight-through outputs to an input of a respective one of the plurality of wavelength  
division demultiplexers and coupled at its protection output the inputs of the spare  
wavelength division de-multiplexer.
2. A protection switching arrangement as claimed in claim 1 wherein the optical  
20 protection switch is a 1xN MEMS switch where the switch matrices have N inputs.
3. A protection switching arrangement as claimed in claim 1 wherein the optical  
protection switch is a 2xN MEMS switch where the switch matrices have N inputs, and  
25 one column of mirrors in the MEMS is used for protection switching.
4. A protection switching arrangement as claimed in claim 1 wherein the optical  
protection switch is a 2xN MEMS switch where the switch matrices have N inputs, and  
one column of mirrors in the MEMS is used for testing.
5. A protection switching arrangement as claimed in claim 1 wherein the optical  
30 protection switch is a 3xN MEMS switch where the switch matrices have N inputs.
6. A protection switching arrangement as claimed in claim 1 wherein the optical  
35 protection switch is a 3xN MEMS switch where the switch matrices have N inputs, and  
one column of mirrors in the MEMS is used for protection switching.

- <sup>7</sup>~~8~~. A protection switching arrangement as claimed in claim 1 wherein the optical protection switch is a  $3 \times N$  MEMS switch where the switch matrices have  $N$  inputs, and one column of mirrors in the MEMS is used for testing.
- 5 <sup>8</sup>~~9~~. A protection switching arrangement as claimed in claim 1 wherein the optical protection switch is a  $3 \times N$  MEMS switch where the switch matrices have  $N$  inputs, and either of two columns of mirrors in the MEMS is used for protection switching.
- 10 <sup>9</sup>~~10~~. A protection switching arrangement as claimed in claim 1 wherein the optical channels are lambdas.
- <sup>10</sup>~~11~~. A protection switching arrangement as claimed in claim 1 further comprising a plurality of optical protection switches corresponding to the plurality of wavelength division demultiplexers, each optical protection switch coupled at its outputs to the inputs of the plurality of optical switching matrices and coupled at its inputs to the outputs of the corresponding wavelength division de-multiplexers.
- 15 <sup>11</sup>~~12~~. A protection switching arrangement as claimed in claim <sup>10</sup>~~11~~ wherein the optical protection switches are  $1 \times M$  MEMS switches where there are  $M$  switch matrices.
- 20 <sup>12</sup>~~13~~. A protection switching arrangement as claimed in claim <sup>10</sup>~~11~~ wherein the optical protection switches are  $2 \times M$  MEMS switches where there are  $M$  switch matrices, and one column of mirrors in the MEMS is used for protection switching.
- 25 <sup>13</sup>~~14~~. A protection switching arrangement as claimed in claim <sup>10</sup>~~11~~ wherein the optical protection switches are  $2 \times M$  MEMS switches where there are  $M$  switch matrices, and one column of mirrors in the MEMS is used for testing the switching matrices.
- 30 <sup>14</sup>~~15~~. A protection switching arrangement as claimed in claim <sup>10</sup>~~11~~ wherein the optical protection switches are  $3 \times M$  MEMS switches where there are  $M$  switch matrices.
- <sup>15</sup>~~16~~. A protection switching arrangement as claimed in claim <sup>10</sup>~~11~~ wherein the optical protection switches are  $3 \times M$  MEMS switches where there are  $M$  switch matrices, and one column of mirrors in the MEMS is used for protection switching.

- <sup>16</sup>  
~~17~~. A protection switching arrangement as claimed in claim 11 wherein the optical protection switches are 3xM MEMS switches where there are M switch matrices, and one column of mirrors in the MEMS is used for testing the switching matrices.
- 5 <sup>17</sup>  
~~18~~. A protection switching arrangement as claimed in claim 11 wherein the optical protection switches are 3xM MEMS switches where there are M switch matrices, and either of two columns of mirrors in the MEMS is used for protection switching.
- <sup>18</sup>  
~~19~~. A protection switching arrangement as claimed in claim 11 wherein the optical channels are lambdas.
- 10 <sup>19</sup>  
~~20~~. A protection switching arrangement comprising  
a first logical layer for switching optical channels;  
a second logical layer for switching a group of optical channels; and  
15 a first coupler for grouping together optical channels of the first logical layer and coupling them to the second logical layer;  
a second coupler for ungrouping grouped optical channels of the second logical layer and coupling them to the first logical layer  
a first protection switch providing an alternative switch path for at least one of  
20 the grouped optical channels from the first logical layer in the second logical layer.
- <sup>20</sup>  
~~21~~. A protection arrangement as claimed in claim <sup>a</sup>~~20~~ further comprising a second protection switch providing an alternative switch path for at least one of the optical channels from the second logical layer in the first logical layer.
- 25 <sup>21</sup>  
~~22~~. A protection switching arrangement for optical switching systems comprising an optical protection switch including:  
a first column of deployable mirrors, each mirror operable for deflecting an optical signal from an optical signal input path to a protection path; and  
30 a second column of deployable mirrors, each mirror operable for deflecting an optical test signal from an optical test signal input path to an optical switch testing path;  
wherein for each mirror of the first column and corresponding mirror of the second column, the respective optical signal input path and optical switch test path are substantially aligned.
- 35 <sup>22</sup>  
~~23~~. A protection arrangement as claimed in claim <sup>21</sup>~~22~~ wherein the first and second columns of mirrors are formed as faces of a deployable prism.

- <sup>23</sup>  
24. A protection switching arrangement for optical switching systems comprising an optical protection switch including:
- 5 a first column of deployable mirrors, each mirror operable for deflecting an optical signal from an optical signal input path to a protection path;
- a second column of deployable mirrors, each mirror operable for deflecting an optical test signal from an optical test signal input path to an optical switch testing path; and
- 10 a third column of deployable mirrors, each mirror operable for deflecting an optical signal from an optical signal input path to a protection path;
- wherein for each mirror of the first and third column and corresponding mirror of the second column, the respective optical signal input path and optical switch test path are substantially aligned.
- 15 <sup>24</sup>  
25. A protection arrangement as claimed in claim 24 wherein the first and second columns of mirrors are formed as faces of a deployable prism.

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